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A STUDY OF
HIGH SCHOOL PUPILS

WITH A VIEW OF DETERMINING THE EXTENT
OF RECOLLECTION OF ONCE FAMILIAR FACTS



A THESIS

Presented to the Faculty of the Graduate School of
the University of Pennsylvania in partial fulfilment
for the degree of Doctor of Philosophy



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EMMANUEL WILSON COBER

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A STUDY OF HIGH SCHOOL PUPILS

Until within the last twenty-five years, one of the dominant notes in grammar school education has been thorough and frequent review of grade work with a view to its permanent retention. This continual review was possible from the fact that the course of study was made up of few subjects limited in scope and content. With the constantly increasing demands made on the public school curriculum by subjects and activities wholly foreign to the formal education of a generation or so ago, the grammar school has become so enlarged in scope and content as to make much of the earlier drill work impossible in the time devoted to it. As much of this mechanical work was of a questionable educative character, its limitation to fewer facts and activities would probably have meant educational betterment, had the change not been accompanied by the reaction against verbal memorizing, which has tended to prevent sufficient drill, or at any rate enough review work for the certain retention of once familiar facts too important to be forgotten. That certain essential facts should constitute a part of every normal child's mental content is admitted by all educators. Just what these facts should be is a disputed question.

Much of our grammar school knowledge is for the purpose of furnishing a background for future educational development. Some of it is not supposed to be remembered but is for the purpose of discipline. Some of it is remembered for some time and then forgotten, but can easily be revived with little review.

With many people it is not uncommon to expect children to remember all they learn. This is illustrated by the action of the school board in a Pennsylvania town, where the principal was removed because in a teachers' examination certain of the high school pupils failed to remember facts which were a part of their grammar school course. There have been other investigations prompted by a similar

motive, among which may be cited an examination of the first year pupils of Washington, D. C. in 1900.

1,188 pupils were examined in common school branches which had been laid aside for nine months. The examination was at the instance of a senate committee and the questions were prepared by the chief examiner of the civil service commission and accepted by the director of the high schools. The pupils did not know before hand of an examination and so could not prepare with that in mind, as in the case of a civil service or teachers' examination. In arithmetic the average per cent. of correct answers to the eleven questions given was 58.8. This is the average of the 1,188 first year high school pupils of the six high schools in Washington, two of which are attended by colored students. The examination in spelling was upon words used in answering the history questions. The words which each pupil used were counted and the average number of words misspelled by each ranged from 3 to 6 per cent. In history the average per cent. of correct answers to the five questions was 53.10 (ranging through 44, 48, 52, 56, 59 for the six schools). Nineteen pupils made 70 per cent. or over.

The result of this and similar investigations has been the charge that the elementary school course is a failure, usually coupled with the suggestion that the failure is due to the influx of "fads" and educational experiments into the course of study. Now because facts once familiar to grammar school pupils are not recalled after an interval, does not prove that they were not perfectly familiar to the pupil at some previous time, neither is it an argument against the efficiency of work in the grammar school. In Psychology, the experiments of Ebbinghaus* have shown conclusively that words and nonsense syllables cannot be so adequately memorized when first presented; that they can not be cer-

*Uber das Gedachniss, (1885) p. 64.

tainly retained in the memory and readily recalled in the absence of occasional review.

The purpose of this piece of research work was to make an inductive study of high schools of recognized standing, primarily with a view to determining how long facts are remembered which were known with maximum certainty at the end of the grammar school course but which have not been reviewed since; and incidentally, so far as a limited investigation may indicate, the length of the interval which may elapse between reviews without such facts passing beyond the range of ready recall.

At the outset a very serious difficulty presents itself to the investigator. It cannot be assumed merely because facts are included in the work prescribed for the eighth school year that they were at one time thoroughly familiar to a given group of high school pupils. On the other hand it was impracticable with a large mass of pupils enrolled in various high schools, to limit the investigation to facts upon which the pupils were tested at the close of the grammar years together with the precise percentage of correct replies received in such a test. Fortunately this is not at all necessary. The test does not concern itself with the exact proportion of facts which are forgotten in a definite period of time, and so does not need to compare the percentage of correct replies made by a given individual with a similar percentage obtained in response to the same questions at the time when he left the grammar grades. But it is essential to know, first, that the facts asked for were among those most persistently drilled upon in the grammar grades and that they were included in the questions that determined promotion to the high school; and, second, that they were not reviewed either systematically or incidentally in connection with high school work, and were little likely to be called to mind outside of the school.

Selection was therefore made, in the first place, from facts which constituted part of the work prescribed as essential in a detailed course of study and included in tests that determined promotion to the high school, but were submitted to grammar school principals and rejected, in case they were not admitted to be among the details of the work upon which the pupils were most persistently drilled, and with which they could safely be assumed to be most familiar.

It is to be clearly understood that the questions finally selected were chosen solely from the fact that they met the conditions necessary to a satisfactory experiment, and not on account of their relative worth from the standpoint of the educational aim. In order that the disturbing influence of review or allusion may be so far as possible removed, the questions were largely limited to such portions of Physical Geography and United States History as have little bearing on high school work. There being no uniform course of study for the high schools investigated, a few of the questions in the list are reviewed in one or two of these high schools. Where this is the case the fact is noted and in working out the percentages, the results for such questions are omitted. For the same reason facts that were found to have been covered in regular class work between the first and second test are also noted and omitted in the percentages.

As some school systems are averse to any work given by one who is not officially connected with the system, especially if it will take much time, the questions were so framed as to require but a word or two in reply, and so to consume the least possible time in making the test.

The questions have been grouped under nine different heads; each designated by a Roman numeral. Those under each of the nine general groups are in most cases selected with some definite object in mind for such grouping. The

effort to include in each group only such questions as are logically related, was subordinated to the selection of questions most certain to have been once mastered and less likely to have been incidentally recalled. In number I, all require numbers for answers and all with the exception of (1) are dates. In number II, all but (5) call for answers in general location in time. In number III and VIII, are questions calling for geographical facts which probably require more visualizing than any other questions in the list. Number IV consists of historical questions though (3) would occur in the work in geography. The answers to numbers V and VI respectively involve associations in geographical and historical sequence. Number IX is the preamble to the Constitution of the United States.

I (1) What is the inclination in degrees of the axis of the earth?

In what year did the following events occur?

- (2) The introduction of slavery into Virginia.
- (3) The Missouri Compromise.
- (4) The landing of the Pilgrim Fathers.
- (5) The discovery of gold in California.

II In whose administration did the following events occur?

- (1) Invention of the cotton gin.
- (2) Nullification Act.
- (3) The purchase of Louisiana.
- (4) In what war was the battle of Saratoga (Stillwater) fought?
- (5) To what party did John Adams belong?

III (1) What large island north of Australia?

- (2) What sea north of South America?
- (3) What mountain range in Northern Africa?
- (4) What river between United States and Mexico?

- (5) What cape at the southern extremity of Africa?
- IV (1) By whom was the Mississippi river discovered?
(2) Who was the author of the Missouri Compromise?
(3) By what title is the modern ruler of Egypt known?
(4) How many years in the term of a U. S. Senator?
(5) Who was president of the Southern Confederacy?
- V Beginning on the East—name in order the five Gulf States.
- VI Name in order the first five presidents of the United States.
- VII For what achievement are the following men noted?
(1) Cyrus W. Field.
(2) Robert Morris.
(3) Cortez.
(4) General Gates.
(5) Samuel F. B. Morse.
- VIII Name the capitals of the following countries:
(1) Switzerland.
(2) United States of Columbia.
In what countries are the following cities located?
(3) Marseilles.
(4) Para.
(5) Odessa.
- IX Give the preamble to the Constitution of the United States.

Many questions which have to do with matters of local interest were omitted so as to make the test applicable in various cities. The answer to some questions would lead to confusion and therefore were omitted. For example,

"Name the largest of the Sandwich Islands." Here the answer "Hawaii" might be confused with the group of islands known by that name. Another example is the question, "Name the three branches (departments) of government of the United States." Here through their occurrence of a group of three, there might be a confusion of the Senate, House, and President with the Legislative, Executive, and Judicial departments.

Another type of question which has been omitted from the list is that in which the answers might easily be estimated. For example, "When did the second Continental Congress convene?" Here the date might be guessed from that of the Declaration of Independence. "Upon which of these cities does the sun shine first every morning, Pittsburgh or Philadelphia?" Here a guess has one chance in two of being correct. "In what zones is Africa located?" Knowledge of the fact that Africa is an equatorial region would suggest the torrid zone.

As mentioned before, such questions as involve much reasoning or a comparative judgment are not included in the list. For example, "Name and locate the most important battle fought outside the limits of the seceded states." "Go by water from Baltimore to Calcutta: a. State the general direction in which you would travel. b. Name the bodies of water on which you would sail." Here too much opportunity is given for variation in the details named.

The examples cited under these different types are actual questions which have been given to children in the eighth grade examination for promotion to the high school. They are not rejected because they are considered improper questions for eighth grade pupils but because they do not conform with the purpose of this investigation.

With the list of questions given on pages five and six, the test was given in seven different schools higher than the

eighth grammar grade, the number of pupils ranging from 187 to 396 in each school. If by classes we understand 1st, 2nd, 3rd, 4th and 5th years above the eighth grade, in one school five classes were represented, in four schools four classes, in one school two classes—those of the 1st and 2nd year, and in one school, pupils five years removed from the eighth grade were tested.

The numbers of successive tests also varied. In one school, but one test was given. In five schools the test was given a second time after an interval varying from seven to twenty days. In one school the test was given a second time after an interval of twenty-one days. Discarding those pupils who were absent from one test, though present in another in the same school, (199 in the whole investigation) left 2,485 papers to use as a basis to draw conclusions from. There were, omitting the 199 before mentioned, 1,362 different pupils represented in the test, distributed among classes above the eighth grade as follows:

First year.....	588
Second year.....	324
Third year.....	184
Fourth year.....	113
Fifth year.....	153

Classified by sexes they were grouped as follows:

	Boys	Girls
First year.....	318	270
Second year.....	150	174
Third year.....	76	108
Fourth year.....	45	68
Fifth year.....	0	153

In subsequent tables for each school the tabulated results will show the number of correct answers for each question according to class and sex.

In order to eliminate the personal equation and insure

uniformity in work I conducted the tests in person. They were in all cases given in the forenoon. The first was on December 15th, 1908. This was the preliminary test and will be explained later. The tests which were given and repeated began with February 3rd, 1909 and ended April 23rd, 1909. The weather conditions during each test are carefully noted.

By previous arrangement with the principals, the program was so planned as to allow the test to be given in some schools to all pupils at once, in others, to two or more groups of pupils. In each case the teachers gave assistance in distributing and collecting papers, also in arranging the seating so as to allow no pupils to sit side by side. The principals explained the object of the test, making it clear that its results had no influence one way or the other in determining the standing of pupils in their school work. Therefore it was of no advantage to do dishonest work. but it was of the utmost importance, at least from an experimental and scientific point of view, to do the best work of which each was capable. The pupils were furnished paper on which were printed numbers and blanks and this greatly facilitated the test, and was a great economizer of time, both for the test and in correcting the papers.

The following is a copy of the blank used :

EXTENT OF RECOLLECTION OF ONCE FAMILIAR FACTS

SCHOOL	CLASS	NAME	DATE
I. 1.	2.	3.	4. 5.
II. 1.	2.	3.	4.
5.			
III. 1.	2.	3.	4.
5.			
IV. 1.	2.	3.	4. 5.
V. 1.	2.	3.	4. 5.
VI. 1.	2.	3.	4.
5.			
VII. 1.		2.	
3.		4.	
5.			
VIII. 1.	2.	3.	4. 5.
IX. X.			

Before beginning the test, each pupil was asked to write in the places provided at the top of the blank, the name of the school, his class, his name, and the date. In order to classify the papers by sex the, first name was written in full. It was made clear to all that the questions about to be

read would correspond in their numbering to the numbers used on the blanks before them. The answers were to be written in the shortest form possible. I then began. "Roman I. 1. What is the inclination in degrees of the axis of the earth?" repeating the question. No interruption by the pupils in asking questions, or by myself in explaining questions was allowed to interfere with this part of the work. The time allowed for the actual writing was for questions I and VII. less than twenty seconds for each of the five parts of each question, for II, III, IV, VIII less than seventeen seconds. For questions V. and VI. seventy-five seconds was allowed for each, while five to eight minutes was allowed for question IX. When the test was given the second time, the pupils were familiar with the method of procedure and so less time was allowed for the second test. Where the test was repeated the third time, the questions were more familiar and therefore the time was not as long as for the second test.

With the completion of question IX the papers were collected and I read the questions again giving the correct answer to each. Pupils were now allowed to ask questions and I made explanations of the questions and of the answers, if the pupils asked for it. This constituted the review. Nothing was said of repeating the test at some future time and the pupils and teachers usually, with the exception of the principal, did not expect a repetition. The whole exercise was conducted in less than forty minutes, sometimes during a study period, but mostly during a regular class period, which was set aside for this purpose. But in no case was the test given in any school to one group before and to another group after an intermission, which would allow pupils to meet and discuss the test. Principals and teachers if they knew of the proposed repetition, were asked not to discuss this with the pupils.

The objection was raised by one principal, that such a test of disconnected questions, in which little more than sufficient time was given than was required to write the answer and so very little time to think about each question would not be a fair test, especially for the pupil of phlegmatic temperament. In this connection it must be remembered that the questions were selected because a memory test was the object and not a test involving reasoning and logical analysis. It was also very evident in conducting this study in the various schools that there was an added stimulus for each pupil to do his best. An unusual exercise given by a stranger and in no way connected with the school system, and also the fact that the result of each pupil would in a measure reflect the standing of the school if compared with other schools, would be a strong incentive to get the best the pupil could give.

The papers were all corrected and tabulated by myself and so the personal equation was here eliminated as well as in conducting the test. The answer was either right or wrong, but as it was sometimes difficult to say whether it was right or wrong, by one person correcting the papers, uniformity at least was preserved. Before beginning the correction of papers of any one school, the names of those in the first test were compared with those of the second and the third test (where this was given) and all pupils absent for either one of the tests were eliminated. The same pupils therefore figure in the various tests of the same school.

In marking question IX, which is one involving a great deal of association, the occasional omission of a word not vital to the sense or the misuse of such a word, does not make the answer wrong. Questions V and VI are each divided into five parts and so easily tabulated if partially right. (a), (b), (c), (d), (e) are respectively used to refer to those given correctly. For example, an answer giving

four of the possible five Gulf States correctly and in order is scored under (d). An answer giving three of the presidents correctly and in order is scored under (c). It is evident that those who name four states correctly and in order also name three, but in scoring, complications would arise which have led me to follow the method described.

A preliminary test was given to a high school of 396 pupils—193 boys and 203 girls. This test helped to formulate the final plan, a description of which has been given. The method of conducting this preliminary test differed from the final plan in this: If the pupils could not answer the question in the allotted time they were asked to draw a line instead. After all the questions were given they were repeated from the beginning, and the pupils given a second opportunity to write the answer over the line previously drawn. If now they did not know the answer they were asked to put a check mark, provided the fact was never known to them. This complicated system was found to be confusing. The drawing of lines and checking of questions by the pupils was not accurate, for in correcting the papers it was found that many of the questions unanswered were checked. Often a question which was answered correctly was partly erased and checked, showing that the checking was used as a means of concealing the pupil's certainty of the correct answer.

SCHOOL No. 1

Class		Fresh			Soph.			Junior			Senior			Totals			
No. of Pupils		240			93			53			10			396			
		First Attempt	No. added sec'nd attempt	Fact never known by	First	No. added	Never known	First	No. added	Never known	First	No. added	Never known	First attempt	No. added sec'nd attempt	Fact never known	No. Answered first and second attempt
I	1	38	2	55	39	1	0	17	1	8	9	0	1	103	4	64	107
	2	24	2	18	4	0	0	0	0	4	0	0	0	28	2	22	30
	3	8	4	26	1	0	1	0	0	7	2	0	1	11	4	35	15
	4	65	5	16	25	5	1	18	2	1	4	1	0	112	13	18	125
	5	38	0	17	4	0	1	3	0	3	0	0	0	45	6	21	45
II	1	32	3	9	0	0	0	1	0	0	0	0	1	33	3	10	36
	2	13	1	32	2	3	6	0	0	8	0	0	4	15	4	50	19
	3	141	1	9	46	1	1	25	0	1	5	0	1	217	2	12	219
	4	130	7	4	43	1	2	20	0	1	7	1	0	200	9	7	209
	5																
III	1	2	1	38	0	0	17	0	0	5	0	0	1	2	1	61	3
	2	83	3	10	42	2	2	17	0	2	1	0	1	143	5	15	148
	3	119	2	73	4	1	10	3	0	5	2	0	1	128	3	89	131
	4	183	0	2	68	0	1	35	1	2	7	0	0	293	1	5	294
	5	103	4	15	32	3	3	25	1	2	3	0	0	163	8	20	171
IV	1	172	3	6	53	1	2	37	0	0	8	0	0	270	4	8	274
	2	91	5	13	17	1	7	2	0	6	2	0	0	112	6	26	118
	3	3	1	72	1	0	26	6	0	7	0	0	5	10	1	10	11
	4	29	0	1	10	0	0	14	0	1	5	0	0	58	0	2	58
	5	96	7	19	32	1	4	28	1	2	4	0	2	160	9	27	169
V	(e)	73	3	8	34	1	0	19	0	0	5	0	0	131	4	8	135
VI	(e)	46	0	11	10	0	0	11	0	0	1	0	1	68	0	12	68
VII	1	31	1	74	11	0	14	6	0	11	1	0	3	49	1	102	50
	2	82	4	27	27	4	3	13	0	3	4	1	0	126	9	33	135
	3	29	3	57	7	0	9	9	1	7	5	0	0	50	4	73	54
	4	35	1	30	10	0	4	10	2	3	3	0	0	58	3	37	61
	5	164	3	22	54	1	1	25	2	1	7	0	0	240	6	24	246
VIII	1	44	1	35	13	0	9	15	2	2	0	0	1	72	3	47	75
	2	17	1	39	1	1	10	4	0	2	0	0	0	22	2	51	24
	3	31	3	46	11	2	11	17	1	6	5	0	1	64	6	64	70
	4	19	1	56	8	2	13	1	0	7	0	0	3	28	3	79	31
	5	63	2	36	19	2	11	19	0	5	2	0	3	103	4	55	107
IX		20	0	38	4	0	11	2	0	3	7	0	0	33	0	52	33

SCHOOL No. 1.

The preceding table shows the result of the preliminary

test. At the top are indicated the class and number of pupils in each class, to the right, the totals. The figures "38" following I. 1 indicates the number of pupils in the freshman class who answered question I. 1 correctly on the first attempt. 2 wrote the answer on the second trial and 55 checked the question. 103 in the school of 396 answered question I. 1 correctly on the first attempt, 4 on the second, and 64 said they never knew the fact. 107 after two trials succeeded in answering the first question. In question V and VI only those who have given the facts correctly and in order (the 5 states in V and the 5 presidents in VI) are scored.

Question II. 5 is left blank because this question, "To what party did Henry Clay belong" was later discovered to be an unfair question, for during his political career, Clay was at different times affiliated with three different political parties.

Question VIII. 3 for this preliminary test was Barcelona. This was changed to Marseilles for the final tests because of the prominence given through the daily papers to an earthquake in Spain in the immediate vicinity of Barcelona.

This school is composed of boys and girls, but they are not separated in the tabulations. The test was given Dec. 15th, 1908, and not repeated. It should be noted that question I. 1 is studied in the regular course in astronomy for the senior year.

SCHOOL No. 2

In this school the first test was given February 3, 1909, and the second February 23, 1909. Interval—20 days. Weather conditions: First test—fair; Second test—rain.

Class D for the most part does work corresponding to the first high school year although in this particular school class E (which was not tested) is nominally the first year in the high school. For this investigation, Class D. is then considered as the first year, C as the second, B as the third and A as the fourth. At the top are indicated the class, number in each class, and sex. It should be noted that the boys and girls do practically the same work but not in the same classes. There are separate departments for the boys and girls. The first test is indicated by the figure "1" and the second test by "2" in the space "No. of Test." In the schools preparing for this school question IX is not taught.

SCHOOL No. 3

No. of Pupils No. of Tests		145	
		1st.	2nd.
I	1.....	71	143
	2.....	34	124
	3.....	14	109
	4.....	102	130
	5.....	61	128
II	1.....	103	137
	2.....	88	126
	3.....	116	134
	4.....	104	144
	5.....	64	139
III	1.....	19	124
	2.....	117	145
	3.....	90	144
	4.....	141	145
	5.....	144	145
IV	1.....	116	145
	2.....	73	138
	3.....	81	132
	4.....	126	138
	5.....	130	136
V	(a).....	25	6
	(b).....	8	
	(c).....	1	
	(d).....		
	(e).....	102	138
VI	(a).....	31	9
	(b).....	5	1
	(c).....	33	4
	(d).....	8	
	(e).....	44	128
VII	1.....	50	140
	2.....	84	135
	3.....	87	136
	4.....	34	129
	5.....	117	142
VIII	1.....	54	137
	2.....	74	136
	3.....	145	145
	4.....	79	141
	5.....	136	142
IX	68	82

SCHOOL No. 3

In this school the first test was given February 24th, 1909 and the second, March 3rd, 1909. Interval—7 days.

Weather conditions : first test—clear ; second test—rain.

This is a girls school and the test included only one class which is the fifth year removed from the grammar school. As all of these girls are preparing themselves for teachers, they cover most if not all the questions of the test in some form.

Questions III. 2 and 3 were touched upon in class work before the first test. III. 4 was covered by about one half of the class before the first test. IV. 1 was also taken up in the class work. Special emphasis is given to VII. 2 and 3 in course and it was expected that the pupils would be perfect in these for the second test. The results are for the most part better here than in the other schools tested. The improvement as indicated by the second test would be phenomenal for the average school. There was no doubt an added incentive to give more than a passing interest to these questions from the fact that all these girls expect to be teachers. Within a year or two they will all be required to pass examinations involving questions of just such a character as this test furnishes. The average high school pupil would be little concerned in trying to recall the fact, whereas those who know that they will be examined for teachers' certificates involving subjects used in this investigation, would naturally make a special effort to retain the fact. These reasons, I am confident, explain why so large a number of pupils answered every question correctly on the second test. It must also be borne in mind that the time interval here was only seven days.

SCHOOL No. 4

Class	No. in test.....	B 26		C 70		E 15		F 27		Totals 138	
		1	2	1	2	1	2	1	2	1	2
I	1	26	26	61	68	13	13	24	26	124	133
	2	1	23	31	51	9	13	20	26	61	113
	3	12	23	31	55	3	11	17	25	63	114
	4	12	17	40	51	5	9	16	24	73	101
	5	15	22	34	53	10	11	13	24	72	110
II	1	10	26	39	62	9	14	20	26	78	128
	2	8	13	35	55	11	12	22	26	76	106
	3	22	25	62	64	14	12	25	26	123	127
	4	18	24	59	68	9	14	25	27	111	133
	5	9	21	39	58	8	14	16	22	72	115
III	1	5	16	39	63	9	11	22	25	75	115
	2	25	26	66	68	14	14	26	26	131	134
	3	10	23	49	59	12	14	23	26	94	122
	4	23	26	67	69	15	15	26	27	131	137
	5	15	26	64	67	15	15	22	23	116	131
IV	1	17	22	44	61	10	14	22	26	93	123
	2	18	22	58	66	12	14	26	26	114	128
	3	11	19	18	49	2	10	14	22	45	100
	4	16	26	42	65	9	13	24	25	91	129
	5	25	26	57	64	14	15	26	27	122	132
V	(a)	7	3	10	4	7	0	3	1	27	8
	(b)	2	6	6	4	3	2	3	1	14	13
	(c)	0	0	0	0	0	0	0	1	0	1
	(d)	4	0	0	1	1	0	0	0	5	1
	(e)	9	16	49	60	31	13	19	24	80	113
VI	(a)	4	2	7	6	1	0	0	1	12	9
	(b)	3	1	4	6	2	0	0	0	11	5
	(c)	6	2	24	10	5	3	4	3	39	18
	(d)	4	3	9	3	2	0	2	1	17	7
	(e)	9	18	25	47	5	12	19	22	58	99
VII	1	14	22	32	59	7	15	19	26	72	122
	2	14	24	40	61	12	14	16	26	82	126
	3	3	18	10	44	3	8	6	18	22	89
	4	13	23	28	53	8	10	12	19	61	105
	5	23	26	54	63	14	14	16	25	107	128
VIII	1	11	19	14	*38	5	8	15	22	45	87
	2	0	10	3	18	0	0	3	15	6	43
	3	26	26	44	44	14	15	26	26	110	111
	4	12	22	37	42	9	13	25	26	83	103
	5	23	25	40	44	14	15	25	25	102	109
IX		13	8	20	16	4	4	26	18	63	46

113 In test for VIII and IX.

* For class C in VIII and IX.

45 Pupils instead of 70.

SCHOOL No. 4

First Test—February 19th, 1909.

Second Test—March 5th, 1909.

Interval—14 days.

Weather condition :

First test.....Clear and Cold

Second test.....Cloudy

This is a boys' school and but two years are represented in the test—the first and second years of high school work. Classes C and F are first year pupils. Classes B and E. are second year pupils. They are divided as indicated in the table, because they entered the high school as follows :

Class F—February, 1909.

Class C—September, 1908.

Class E—February, 1908

Class B—September, 1907.

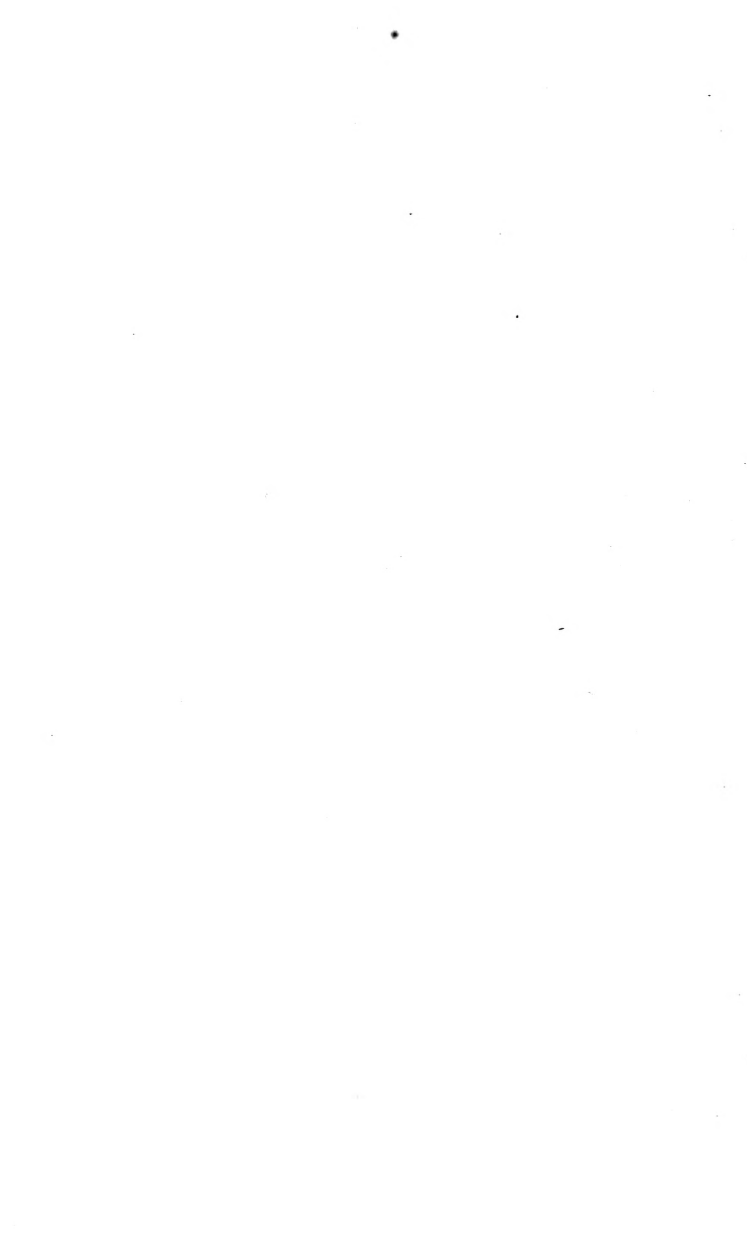
Because of an unforeseen circumstance while the First test was given to one section of Class C, the period was so shortened that the questions were completed only to question VII. When the test was given the second time, work was stopped with the completion of number VII so as to conform with test one of the class. It must therefore be remembered that for question VIII and IX of Class C, there were 45 pupils instead of 70. The total number of pupils in the test for questions VIII and IX is 113, instead of 138.

Question VIII. 3 was taken up by Class B in class work about the time of the test. It should be noted that Class F was promoted to the high school but two weeks before the first test was given and so was quite familiar with the question as shown in the results.



TOTALS

2			13			50			107					
16			8			Boys			Girls			157		
Girls			Girls											
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1	16	16	7	8	8	6	48	48	14	98	104	20	146	152
7	14	16	8	8	8	5	29	35	33	72	77	38	101	112
12	16	16	6	8	8	4	28	28	22	67	74	26	95	102
11	14	16	7	8	8	11	33	36	43	80	97	54	113	133
14	15	15	3	8	8	20	36	46	28	73	75	48	109	121
13	16	15	0	8	8	2	43	48	38	98	102	40	141	150
10	15	16	1	8	8	4	29	35	21	56	77	25	85	112
16	12	16	6	8	8	27	36	43	65	83	89	92	119	132
12	16	16	7	8	8	29	47	50	56	103	105	85	150	155
3	13	14	6	8	8	1	43	47	12	87	97	13	103	144
7	9	12	6	8	8	0	41	45	15	58	84	15	90	129
16	16	16	8	8	8	29	48	49	60	98	98	89	146	147
1	14	14	8	8	8	14	43	48	19	89	97	33	130	145
16	16	16	8	8	8	41	49	49	88	103	105	129	152	154
16	15	16	8	8	8	41	49	50	93	104	104	134	153	154
16	14	15	8	8	8	19	43	48	67	99	102	86	142	150
13	16	16	1	8	8	14	37	46	32	76	90	46	113	139
1	10	9	7	8	8	6	37	45	24	61	74	30	98	119
6	14	16	5	8	8	15	48	50	32	97	104	47	143	154
16	16	16	8	8	8	35	48	48	71	96	97	106	144	145
6	2	1	1	0	0	15	8	4	42	20	16	57	28	20
0	0	0	1	2	0	2	6	5	8	15	8	10	21	13
0	0	1	0	0	0	0	1	0	3	5	5	3	6	5
0	0	1	0	0	0	0	0	0	0	0	3	0	0	3
0	14	13	4	6	8	17	32	40	25	56	73	42	88	113
0	0	1	1	0	0	7	6	2	8	3	4	15	9	6
1	0	0	1	0	0	2	1	1	4	0	4	6	1	5
2	1	0	1	0	0	10	0	3	37	10	5	47	10	8
0	0	1	2	0	0	1	0	1	10	1	2	11	1	3
3	15	14	3	8	8	25	43	43	41	92	92	66	135	135
4	13	16	6	8	8	13	45	50	19	73	85	32	118	125
9	14	15	2	8	8	21	19	47	31	69	76	52	88	123
4	15	15	6	8	8	19	39	44	40	78	91	59	117	135
8	12	15	1	6	8	8	37	44	15	48	69	23	85	113
6	16	16	6	8	8	37	43	49	76	92	95	113	135	134
5	11	11	7	8	8	19	43	46	40	82	88	59	125	134
1	10	13	7	8	8	1	28	35	12	38	69	13	66	104
6	16	16	8	8	8	41	49	50	97	105	106	138	154	156
6	10	15	8	8	8	24	42	48	40	89	91	64	131	139
1	15	16	7	8	8	24	47	49	72	90	101	96	137	150
0	1	4	7	7	8	2	8	6	10	21	24	12	29	30



SCHOOL No. 5

First test given March 3rd, 1909.

Third test given March 30th, 1909.

Second test given March 9th, 1909.

In this school three tests were given with seven days interval between the first and second test, and 21 days interval between the second and third tests.

Weather conditions:

First test.....Rain

Second test.....Rain

Third test.....Clear

Class 9 is the first year class, 10 the second, 11 the third and 12 the fourth year in the high school. Class 13 is the fifth year above the eighth grade, composed of girls who expect to become teachers and give some time to the review of the common branches.

Class 12 cover I. 2, 3, 4, 5, also questions II, IV, V and VI in United States History, although the boys' column would not indicate it.



SCHOOL No. 5

		TOTALS																																				
Class		9			10			11			12			13			50			107																		
Number in Test		26			44			14			30			5			9			5			16			8			Boys			Girls			157			
Sex		Boys			Girls			Boys			Girls			Boys			Girls			Boys			Girls			Girls												
Number of Test		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3				
I	1	0	24	25	0	39	44	4	14	13	2	25	29	0	5	5	0	1	4	5	4	5	1	16	16	7	8	8	6	48	48	14	98	104	20	146	152	
	2	2	16	22	13	27	33	1	5	6	2	15	23	0	0	0	0	0	0	0	0	0	0	14	16	7	8	8	5	29	35	13	33	33	7	38	101	112
	3	2	12	14	4	28	27	0	0	6	6	18	0	0	0	0	0	0	0	0	0	0	0	12	16	7	8	8	4	28	22	67	74	26	95	102		
	4	5	17	20	19	31	36	0	1	7	0	6	19	0	0	4	0	0	0	0	0	0	0	14	15	7	8	8	11	33	36	43	54	113	133			
	5	11	17	20	5	39	34	6	11	12	2	12	20	3	5	5	0	0	0	0	0	0	0	14	15	7	8	8	20	36	46	28	73	48	109	121		
II	1	0	21	26	11	41	43	1	12	7	2	24	29	1	5	5	0	0	0	5	5	5	13	16	15	0	8	8	2	43	48	38	98	102	40	141	150	
	2	2	15	19	3	21	29	1	5	7	2	16	21	0	0	0	0	0	0	0	0	0	0	10	15	0	4	4	4	29	35	22	56	77	85	112		
	3	18	20	23	25	36	38	4	7	9	8	18	21	0	0	0	0	0	0	0	0	0	0	16	16	0	4	4	6	36	43	65	83	89	92	119	132	
	4	14	24	26	17	42	43	9	13	14	11	28	29	0	0	0	0	0	0	0	0	0	0	12	16	7	8	8	27	50	56	103	165	85	150	155		
	5	0	13	15	0	35	38	1	11	3	3	23	28	0	0	0	0	0	0	0	0	0	0	13	14	6	8	8	1	43	47	12	97	13	103	144		
III	1	0	24	25	0	24	39	0	9	11	2	13	18	0	0	0	0	0	0	0	0	0	0	16	16	6	8	8	0	41	45	15	58	84	15	96	129	
	2	16	25	26	17	40	40	6	13	13	10	25	25	0	0	0	0	0	0	0	0	0	0	16	16	12	6	8	29	48	49	60	98	98	146	147		
	3	9	19	25	6	33	39	3	12	13	3	25	27	0	0	0	0	0	0	0	0	0	0	14	14	4	43	48	14	43	48	19	89	97	33	130	145	
	4	12	25	26	29	42	44	9	14	14	26	28	28	0	0	0	0	0	0	0	0	0	0	14	16	16	8	8	41	49	48	88	103	105	129	152	154	
	5	12	15	15	26	39	43	43	10	14	14	39	29	5	5	5	0	0	0	0	0	0	0	16	15	16	8	8	41	49	50	93	104	104	134	153	154	
IV	1	9	23	26	17	41	42	5	11	13	20	27	28	5	5	5	6	9	9	0	4	4	4	16	14	15	8	8	8	19	43	48	67	99	102	86	145	150
	2	9	20	25	15	31	38	1	9	11	3	18	19	2	3	5	5	0	3	9	1	3	3	13	16	16	1	8	8	14	37	46	32	76	90	46	113	139
	3	3	18	25	5	20	29	1	12	13	14	14	19	2	2	5	4	8	9	9	0	3	3	1	10	9	1	8	8	6	37	45	24	61	74	30	98	119
	4	9	25	26	12	39	42	5	13	14	3	25	29	1	1	1	6	9	9	0	0	0	0	16	16	16	8	8	8	15	48	50	32	97	104	47	143	154
	5	18	24	25	24	41	40	7	14	13	14	23	24	5	5	5	5	9	9	9	5	5	5	16	16	16	8	8	8	35	48	48	71	96	97	106	144	145
V	(a)	7	3	1	16	8	8	4	3	3	10	10	7	1	1	0	9	0	0	3	1	0	6	2	1	1	0	0	15	8	4	42	26	16	57	28	29	
	(b)	0	4	2	3	6	5	2	2	1	1	4	3	2	0	1	2	0	4	1	0	0	0	1	2	0	2	6	5	8	15	8	10	21	13			
	(c)	0	0	0	2	3	4	0	0	0	0	1	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	3	5	5	3	6	5			
	(d)	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3		
	VI	(a)	11	17	22	6	19	25	3	10	16	5	12	19	3	2	3	0	5	8	0	3	5	10	14	13	4	6	8	17	32	40	25	56	73	42	88	113
(b)		2	2	0	0	5	2	3	1	2	2	3	1	1	2	2	0	0	0	0	0	1	0	0	1	1	0	0	7	6	4	2	8	3	4	15	9	
(c)		0	0	0	1	2	2	0	1	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	4	0	4	6	1	5		
(d)		7	0	0	1	10	5	2	2	0	0	15	4	3	1	0	2	9	0	0	0	0	0	2	1	0	1	0	0	10	0	3	37	10	5	47	10	8
(e)		0	0	0	0	4	1	0	1	0	1	4	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2	0	1	0	1	10	1	2	11	1	3	
VII	1	14	24	24	18	35	37	3	12	11	7	25	24	2	3	3	0	9	9	3	4	5	13	15	14	3	8	8	25	43	43	41	92	92	66	135	135	
	2	8	23	26	6	32	34	5	12	14	2	14	18	0	5	5	1	6	9	0	5	5	4	13	16	6	8	8	13	45	50	19	73	85	32	118	125	
	3	7	18	21	3	21	31	5	11	13	13	27	28	4	5	5	7	7	0	14	9	14	15	12	6	8	8	23	19	39	44	40	78	91	59	117	135	
	4	5	18	21	2	16	27	1	10	13	3	11	12	2	2	5	3	1	3	7	0	4	5	8	12	15	1	6	8	8	37	44	15	48	69	23	85	113
	5	18	21	26	20	35	39	11	13	13	16	24	23	5	5	5	0	9	9	9	3	4	5	16	16	16	6	8	8	37	43	49	76	92	95	113	135	134
VIII	1	13	22	25	14	31	35	3	12	12	7	23	24	3	3	4	4	7	9	0	5	3	5	11	11	7	8	8	19	43	46	40	82	88	56	125	134	
	2	0	16	22	12	32	34	1	8	8	8	30	33	0	1	4	4	7	9	0	7	3	3	1	10	13	7	8	8	1	28	35	12	78	93	60	134	
	3	20	25	26	14	42	43	11	14	10	30	30	39	0	0	0	0	0	0	0	0	0	0	16	16	16	8	8	8	41	49	48	97	106	131	154	156	
	4	17	23	26	11	37	36	1	10	12	12	25	25	5	5	5	3	9	9	2	1	5	5	6	10	15	7	8	8	24	42	48	40	89	91	64	131	139
	5	15	23	26	23	40	40	4	14	13	19	26	28	5	5	5	0	9	9	1	0	0	5	11	15	16	7	8	8	24	47	49	72	90	101	96	137	150
IX	1	6	5	3	12	11	1	1	1	10	1	1	0	0	0	0	0	0	0	0	0	0	1	4	7	7	8	2	8	6	10	21	24	12	29	30		

SCHOOL No. 6

Class	First Year					Second Year					Third Year					4th Year										
	Jr. B2		Jr. B5		Jr. C4	Jr. C6	Mid.B4	Jr. A1	Jr. A6	Sr. C3	Mid.A1	Mid.A2	Sr. B1	Jr. B2		Jr. B5		Jr. C4	Jr. C6	Mid.B4	Jr. A1	Jr. A6	Sr. C3	Mid.A1	Mid.A2	Sr. B1
No. in Test	14	21	23	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
Sex	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
No. of Test	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
(I	1	12	0	18	0	4	20	0	21	0	13	0	15	0	10	0	12	0	5	0	60	2	98	2	158	
	2	0	0	11	0	12	17	1	17	1	3	0	8	0	7	0	4	0	5	1	26	3	49	8	75	
	3	1	1	3	0	6	16	0	6	0	0	0	5	0	0	0	0	0	3	5	29	7	20	43		
	4	4	10	12	19	11	18	14	15	4	7	10	13	9	9	6	15	10	28	49	49	71	96	99	145	
	5	9	7	4	15	8	17	3	16	1	13	0	12	0	8	0	5	0	40	50	58	19	58	59	108	
II	1	0	11	0	17	0	20	0	17	0	10	0	12	0	8	0	15	0	5	0	55	0	84	0	139	
	2	6	0	11	2	0	19	3	1	3	10	0	3	0	2	0	0	0	0	37	48	35	50	62	98	
	3	6	12	6	17	11	22	6	18	7	13	5	14	4	7	10	5	13	30	60	32	95	62	155		
	4	1	8	9	11	1	15	0	15	1	9	10	6	0	3	6	0	6	5	44	13	56	19	103		
	5	1	3	7	9	15	0	5	2	15	0	8	0	7	5	10	0	2	6	55	27	14	56	19	83	
III	1	11	12	14	17	12	15	0	22	16	14	1	10	3	10	10	4	12	5	52	65	48	95	100	160	
	2	10	13	11	17	15	15	2	16	17	13	12	12	10	10	10	0	10	37	57	57	80	59	137		
	3	4	10	14	20	18	21	8	21	16	11	14	15	9	9	9	8	12	53	67	80	134	137	180		
	4	14	13	15	20	15	20	2	18	7	19	14	13	15	9	9	14	14	62	55	102	112	164	143		
	5	16	12	17	14	14	20	2	16	3	10	1	11	5	9	9	6	12	38	70	22	73	60	143		
IV	1	2	9	1	13	5	13	2	18	1	9	0	10	5	7	0	2	15	42	19	53	19	97	19	97	
	2	3	1	1	2	3	8	0	5	1	0	1	0	3	1	1	3	5	27	27	13	56	13	7	146	
	3	1	1	2	20	16	20	0	18	0	19	1	16	1	10	0	12	5	50	5	2	96	7	138		
	4	10	13	10	17	16	20	6	12	7	12	9	14	9	10	3	11	49	63	34	75	83	28	49		
	5	7	5	9	3	10	10	9	12	10	8	4	7	6	4	6	4	27	21	11	12	19	29	30	41	
V (a)	1	3	1	0	1	0	5	1	0	3	1	0	0	0	0	0	0	1	0	0	0	6	0	5	5	
	2	0	6	4	10	2	8	5	1	9	0	5	0	2	6	1	6	10	32	17	37	17	69	3	69	
	3	9	0	2	1	0	14	3	18	6	1	10	6	0	2	2	11	45	17	83	35	128	4	52		
	4	0	0	1	2	1	0	0	0	0	1	0	0	0	0	0	0	2	6	9	4	11	10	7		
	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3	0	5	0	0	
VI (b)	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	6	4	10	2	8	5	1	9	0	5	0	2	6	1	6	10	32	17	37	17	69	3	69	
	3	9	0	2	1	0	14	3	18	6	1	10	6	0	2	2	11	45	17	83	35	128	4	52		
	4	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
VII (c)	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	6	4	10	2	8	5	1	9	0	5	0	2	6	1	6	10	32	17	37	17	69	3	69	
	3	9	0	2	1	0	14	3	18	6	1	10	6	0	2	2	11	45	17	83	35	128	4	52		
	4	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
VIII (d)	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	6	4	10	2	8	5	1	9	0	5	0	2	6	1	6	10	32	17	37	17	69	3	69	
	3	9	0	2	1	0	14	3	18	6	1	10	6	0	2	2	11	45	17	83	35	128	4	52		
	4	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
IX	1	0	12	0	18	0	20	0	21	0	13	0	15	0	10	0	12	0	5	0	60	2	98	2	158	
	2	3	8	10	12	19	11	18	4	7	10	0	13	9	9	6	15	10	28	49	49	71	96	99	145	
	3	4	9	7	4	15	8	17	3	16	1	13	0	12	0	8	0	40	50	58	19	58	59	108		
	4	5	10	13	11	17	15	15	2	16	17	13	12	10	10	10	0	10	37	57	57	80	59	137		
	5	16	12	17	14	14	20	2	16	3	10	1	11	5	9	9	6	12	38	70	22	73	60	143		

SCHOOL No. 6

First test March 23rd, 1909.

Second test April 6th, 1909.

Interval, 14 days.

Weather conditions :

First test.....Clear.

Second test.....Clear

In this table the year is indicated at the top and underneath are the sections which come into use in this school because of a three years course which was later changed to four years. The sections in each case are as follows :

First year—Junior	B ² Boys, second half of year	
“	B ⁵ Girls, second	“ “
“	C ⁴ Boys, first	“ “
“	C ⁶ Girls, first	“ “
Second year—Middle	B ⁴ Girls, second	“ “
Junior	A ¹ Boys, first	“ “
Junior	A ⁶ Girls, first	“ “
Third year—Senior	C ³ Girls, second	“ “
Middle	A ¹ Boys, first	“ “
Middle	A ² Girls, first	“ “
Fourth year—Senior	B ¹ Boys, first	“ “

SCHOOL No. 7

Class	FIRST YEAR				SECOND YEAR				THIRD YEAR				FOURTH YEAR				Totals			
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Number of Pupils	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Sex	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Number of Test	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
I	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
II	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
III	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
IV	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
V	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)
VI	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)
VII	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VIII	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
IX	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

SCHOOL No. 7

First test—April 6th, 1909.

Second test—April 23rd, 1909.

Interval, 17 days.

Weather conditions:

First test.....Clear.

Second test.....Rain.

As the preliminary test made in School No. 1 in a measure changed the mode of procedure, the questions and the method of tabulating results in the succeeding tests, it is omitted in the final summaries. On account of the review of the common school branches given in the fifth high school year, and the additional interest present with pupils who expect to teach such facts as are here involved in our list of questions, the results obtained with fifth year pupils have also been disregarded. This eliminates School No. 3, and a few pupils from School No. 5, all of whom are girls.



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SUMMARY No. 1

In this table is given the actual number of correct answers for each question, also the totals of all questions tabulated by year, number of test, interval between tests, and sex. It will be noticed that questions V, VI and IX are omitted in this summary. These questions differ from the others, in that they are such as have to do with a series of associations, while those tabulated are mere questions of fact, and therefore for the most part, involve nothing but memory.

Column one and two of each year shows the number of correct answers for each question, for the first test. After the first test the time interval separates the results into various groups, one of which had an interval of from 17 to 20 days, one 14 days and one 7 days. The group which had the 7 day interval was given a third test after an interval of 21 days.



SUMMARY No. 1

CLASS		FIRST YEAR					SECOND YEAR					THIRD YEAR					FOURTH YEAR																							
Number of Tests		1	2	2	2	3	1	2	2	2	3	1	2	2	2	3	1	2	2	2	3																			
Intervals Number of Days			17 and 20	14	7	First, 7 Second, 21		17 and 20	14	7	First, 7 Second, 21		17 and 20	14	7	First, 7 Second, 21		17 and 20	14	7	First, 7 Second, 21																			
Number of Pupils		204 144	44 58	134 42	26 44	26 44	107 124	35 57	58 37	14 30	14 30	47 84	32 43	10 32	5 9	5 9	38 45	28 49	5 5	16 16	5 16																			
Sex		B. G.	B. G.	B. G.	B. G.	B. G.	B. G.	B. G.	B. G.	B. G.	B. G.	B. G.	B. G.	B. G.	B. G.	B. G.	B. G.	B. G.	B. G.	B. G.	B. G.																			
I	1	96	12	38	43	126	39	24	39	25	44	48	23	28	43	52	32	14	26	13	29	4	16	25	36	10	27	5	9	5	9	3	16	20	40	5	5	16	5	16
	2	61	20	21	25	91	28	16	27	22	33	14	9	11	17	38	9	5	15	6	23	3	4	7	12	7	12	4	8	3	7	4	12	15	18	3	4	14	4	16
	3	52	14	21	16	86	22	12	28	14	27	15	2	6	14	34	21	6	12	6	18	2	0	1	12	3	5	5	3	3	5	1	14	9	14	5	5	16	5	16
	4	80	63	32	35	109	39	17	31	20	36	39	56	24	36	33	28	7	19	7	29	25	36	19	29	9	29	5	8	4	8	16	37	29	39	5	4	14	5	16
	5	83	15	27	18	101	31	17	30	24	34	55	18	26	28	46	14	11	12	12	20	18	19	19	25	8	13	5	8	5	8	14	20	17	30	5	3	15	5	15
II	1	62	13	38	35	119	34	21	41	26	43	21	10	21	36	51	23	12	24	12	29	1	9	16	29	8	27	5	9	5	9	2	15	19	37	5	5	16	5	15
	2	73	9	19	13	87	5	15	21	19	29	24	8	8	13	28	0	5	8	7	16	3	9	5	16	4	3	4	4	4	8	6	20	12	23	0	5	15	5	16
	3	152	67	37	28	120	30	20	36	23	38	58	26	24	33	47	2	7	18	11	21	14	28	14	26	6	8	5	9	5	6	18	42	16	39	3	4	12	4	16
	4	141	47	43	53	129	35	24	42	26	43	62	41	32	51	49	33	13	28	14	29	26	33	28	33	10	27	5	9	5	9	24	37	28	48	5	5	16	5	16
	5	67	14	33	20	103	29	23	35	25	38	25	11	20	29	45	15	11	23	13	28	9	3	16	25	6	15	5	8	4	9	5	11	18	40	5	5	13	5	14
III	1	64	11	16	21	100	30	24	24	25	39	15	4	18	26	35	13	9	13	11	18	1	2	8	19	5	13	5	4	5	7	1	15	15	25	2	3	9	4	12
	2	157	55	41	49	128	36	25	40	26	40	82	59	31	46	56	35	13	25	13	25	36	38	27	39	10	24	5	9	5	9	25	35	24	46	5	5	16	5	16
	3	95	23	29	34	113	33	22	33	25	39	42	16	26	28	51	27	12	25	13	27	12	3	16	25	10	20	5	9	5	9	7	7	16	40	5	4	14	5	14
	4	176	87	41	51	131	41	25	42	25	44	88	90	31	50	58	35	14	28	14	28	32	60	30	39	10	27	5	9	5	9	36	51	25	47	5	5	16	5	16
	5	175	76	44	45	123	39	27	43	26	43	81	67	34	47	56	34	14	29	14	28	37	46	28	40	9	29	5	9	5	9	35	38	28	45	5	5	15	5	16
IV	1	122	44	40	41	119	30	23	41	26	42	59	50	28	45	50	20	11	27	13	28	25	27	25	32	9	23	5	9	5	9	24	28	26	41	5	4	14	4	15
	2	112	21	33	34	114	31	20	31	25	38	36	17	22	29	44	10	9	18	11	19	11	5	12	24	7	12	5	3	5	9	11	23	15	27	5	3	16	5	16
	3	42	10	17	14	82	7	18	20	25	29	18	6	16	12	35	4	12	14	13	19	4	16	10	17	7	18	5	9	4	9	7	13	22	3	2	10	3	9	
	4	102	34	36	39	116	38	25	39	26	42	40	14	29	41	48	30	13	25	14	29	12	12	29	33	10	28	5	9	5	9	22	42	26	46	5	5	14	5	16
	5	157	48	40	40	114	29	24	41	25	40	82	41	32	35	56	21	14	22	13	24	36	32	29	28	10	25	5	9	5	9	29	36	23	36	5	5	16	5	16
VII	1	86	12	35	35	109	13	23	32	26	34	39	8	28	34	44	8	12	14	14	18	4	14	25	34	5	15	5	6	5	9	10	9	22	37	5	5	13	5	16
	2	94	19	30	24	90	0	22	25	24	28	43	14	24	24	44	1	8	15	13	18	14	10	17	13	5	3	5	7	5	7	15	21	20	35	3	4	14	5	15
	3	42	10	30	9	71	13	18	21	21	31	27	21	11	31	35	7	11	27	13	28	14	11	21	13	8	12	5	7	5	9	16	26	21	29	3	5	15	5	15
	4	57	3	22	12	95	13	18	16	21	27	21	7	18	16	41	6	10	11	13	12	7	6	13	18	5	8	5	3	5	7	5	9	19	19	4	4	12	5	15
	5	137	52	37	35	123	27	21	35	26	39	80	53	33	40	53	19	13	24	13	23	40	24	30	28	9	17	5	9	5	9	29	38	26	39	4	4	16	5	16
VIII	1	50	31	35	32	76	19	22	31	25	35	32	23	29	38	38	11	12	23	12	24	14	10	15	25	8	7	4	9	4	9	13	21	19	37	3	5	11	5	11
	2	7	4	14	11	40	0	16	12	22	28	5	1	14	11	15	3	8	8	13	0	0	6	6	9	1	3	1	0	2	7	1	1	14	12	2	3	10	3	13
	3	153	86	41	52	164	38	25	42	26	43	90	90	35	57	58	34	14	30	14	30	40	74	29	41	10	32	5	9	5	9	34	58	26	47	5	5	16	5	16
	4	91	14	31	23	82	11	23	37	26	36	43	22	27	26	45	16	10	25	12	25	17	8	20	23	8	13	5	9	5	7	14	8	23	25	5	4	10	5	15
	5	116	46	38	46	98	33	23	40	26	40	76	58	33	45	37	30	15	26	13	28	23	28	22	32	10	21	5	1	5	9	18	19	26	34	4	5	15	5	16
Totals		2912	940	959	933	3099	773	633	975	721	1102	1360	874	722	981	1342	521	325	624	355	706	484	583	562	775	227	516	143	214	138	248	445	726	608	1017	124	130	419	142	450
Per cent.		47.5	21.6	72.6	53.6	77	61.3	81.1	73.9	92.4	83.4	42.3	23.4	68.7	57.3	77.1	48	77.3	69.3	84.5	78.4	34.3	25.5	58.5	60	75.6	53.7	94	79.2	92	91.8	39	37.2	72.3	69.1	82.6	86.6	87.2	94.6	91.6

SUMMARY No. 2

No. of Test		FIRST				SECOND				THIRD							
Internal No. of Days		17 and 20				14				7							
No. of Pupils		397		417		139		207		207		111		50		99	
Sex		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
I	1	151	38	67	16	111	79.8	162	78.2	193	93.2	98	88.2	48	90.6	90	90.9
	2	82	20.6	45	10.7	54	38.7	72	35.2	139	67.1	49	44.1	29	58	64	64.6
	3	70	17.6	30	7.1	37	26.6	56	22.2	128	61.3	30	27	23	56	59	59.5
	4	140	35	192	46	95	67.7	159	76.8	156	73.3	96	86.4	38	66	72	72.7
	5	170	40.8	72	42.8	89	64	101	48.7	160	77.2	58	52.2	36	72	65	65.6
II	1	86	21.6	47	11.2	94	67.6	157	75.7	183	88.4	84	75.6	43	86	90	90.9
	2	106	26.7	46	11.2	65	31.4	65	31.4	119	57.5	8	7.2	29	58	48	48.4
	3	242	60.9	163	39	131	65.4	126	60.8	176	85	59	53.1	36	72	75	75.7
	4	233	58.6	158	37.6	131	94.2	185	89.3	193	93.2	95	85.5	47	94	95	95.9
	5	106	26.7	39	9.3	87	62.5	114	35	159	76.8	59	53.1	44	88	79	79.7
III	1	81	20.4	32	7.6	57	41	81	39.1	142	68.5	56	50.4	41	80	50	50.5
	2	300	75.5	187	44.8	123	88.4	160	77.2	199	96.1	95	85.5	48	90.6	90	90.9
	3	156	39.2	49	11.7	87	62.5	127	61.3	179	86.9	80	72	43	86	81	81.8
	4	332	83.6	288	68.1	130	93.5	187	90.3	204	98.5	102	92.7	49	98	95	95.9
	5	328	82.6	227	54.4	134	96.4	177	85.5	193	93.5	103	91.8	50	100	96	96.9
IV	1	230	59.7	159	38.1	119	85.6	159	76.8	183	88.4	73	65.7	43	86	91	91.9
	2	170	42.8	66	15.8	82	58.9	114	55	170	82.1	53	47.7	37	74	68	68.6
	3	71	17.8	39	9.3	56	40.3	65	31.4	127	61.3	29	26.1	37	74	53	53.5
	4	176	44.3	102	24.4	120	86.3	159	76.8	179	86.4	96	86.4	48	90.6	87	87.8
	5	304	76.5	157	37.6	124	89.2	139	67.1	185	89.3	75	67.5	48	90.6	88	88.8
V (a)	1	116	29.2	137	32.8	29	20.8	27	24.1	29	14	28	25.2	8	16	20	20.2
	(b)	56	14	63	15.1	18	12.9	50	13	25	12	29	26.1	6	12	15	15.1
	(c)	7	1.7	17	4	4	2.8	3	1.4	1	4	6	5.4	1	2	5	5
	(d)	9	2.2	5	1.1	1	1.7	4	1.9	6	2.8	0	0	0	0	0	0
	(e)	143	36	62	14.8	43	30.9	97	47.5	145	70	37	53.3	32	64	56	56.5
VI (a)	1	92	23.1	153	36.6	22	15.8	32	15	26	12.5	35	31.5	6	12	3	3
	(b)	37	9.3	38	9.1	24	17.4	29	14	11	5.3	4	3.6	1	2	0	0
	(c)	100	25.1	99	23.7	40	28.7	30	14.5	22	10.6	3	2.7	0	0	10	10.1
	(d)	28	7	28	6.7	5	3.5	6	2.8	7	3.3	0	0	0	0	1	1
	(e)	130	32.7	91	22	58	41.7	108	51.1	143	69	69	62.1	43	86	92	92.9
VII	1	139	35	43	10.2	110	79.1	140	67.6	163	78.7	36	32.6	45	90	65	65.6
	2	163	41.8	65	15.3	91	65.4	96	46.3	142	68.5	4	3.6	39	78	61	61.1
	3	99	24.9	68	16.5	83	59.7	82	39.6	117	56.5	32	28.8	39	78	70	70.7
	4	90	22.6	25	5.9	72	51	65	31.4	145	70	27	24.3	37	72	42	42.4
	5	286	72	167	40	126	90.6	142	68.5	189	91.3	63	56.7	43	86	84	84.8
VIII	1	109	27.4	85	20.3	98	70.5	132	63.7	125	60.3	37	33.3	43	86	74	74.7
	2	13	3.2	6	1.4	48	34.5	43	20.7	58	28	6	5.4	28	54	30	30.3
	3	317	79.8	317	76	131	94.2	187	90.3	177	85.5	104	93.6	49	98	97	97.9
	4	165	41.3	52	12.4	101	72.6	97	46.8	140	67.6	40	36	42	84	81	81.8
	5	233	58.6	151	36.2	119	85.6	157	75.8	169	81.1	84	75.6	48	90.6	82	82.8
IX		85	21.4	55	13.1	37	26.6	42	20.2	97	46.8	30	27	8	16	14	14.1
																6	12

SUMMARY No. 2

In this table the results for each question are summarized in groups for the number of test, interval between tests and sex. There is no division of pupils according to years in this summary. The first column gives the number of correct answers of that group for each question. The second column is the per cent.

The answers to the questions used as the basis of this study were, so far as it is possible to determine, at one time a part of the mental content of every pupil tested. All of the principals where the test was given, considered the questions fair, except the principal of School No. 2, who said that question IX was not a part of the work of the grammar schools which prepared for his institution. The first test was given from 9 to 11 months after the pupils had left the grammar school, excepting in the case of 27 boys who were in the first test in School No. 4 two weeks after they left the eighth grade. Results show that 47.5 per cent of the questions were answered by the boys and 21.6 per cent. by the girls. In the 9 to 11 months which elapsed between the date on which they left the grammar school and that on which the first tests were taken, over 50 per cent. of the facts were forgotten by the majority of pupils. Only a test made at the very beginning of the fall term would show to what extent the facts were remembered after the necessary interval of vacation.

It would be naturally inferred, that in the second year of the high school the percentage would be lower than in the first and lower in the third than in the second. The results of our investigation in case of the boys show this to be true. 47.5, 42.3 and 34.3 are the percentages for the first, second and third years respectively. In the case of the girls there is a slight increase with the three years; 21.6 for the first, 23.4 for the second and 25.5 for the third. While this investiga-

tion shows an average of 39 per cent. for the boys and 37.2 for the girls in the fourth year, it does not follow that review work should be postponed until this year. This higher percentage in the fourth year may be accounted for by "the survival of the fittest" of pupils who in various ways incidentally review their early school work, and are far superior to the lower classes from an apperceptive viewpoint.

Out of 33 questions only 5 were correctly answered by 75 per cent. or more of all the pupils tested in the four classes—4 in case of the boys and 1 in case of the girls. There seems then ample justification for review of once familiar facts if such facts are to be of any practical value after leaving the grammar grades.

The results of the Washington test* show that 9 months after leaving the grades, over 40 per cent. of the grammar school content cannot be recalled readily. It is just as much a part of the high school work to review early learned facts as to learn new ones. In some high schools it is customary to review common school branches in the fourth year. If this is necessary for pupils who remain in the high school until graduation, it is especially important for the large number who do not reach the second and third year.

The results indicate that many once familiar facts will be forgotten, if review is postponed beyond the first months of the high school course. Just what facts are so important that they should always be ready for recall is not in the province of this discussion, but whatever they may be, they should be reviewed for practical efficiency in society and to develop mental content for future life work.

The results throw little light upon the length of interval desirable between reviews.

*Senate Report 711, pt. 2, 56th cong. 1st Session. School Examination.

		Per cent. of correct answers	
		Boys	Girls
17—20 day interval..	{ First year.....	72.6	53.6
	{ Second year.....	68.7	57.3
	{ Third year.....	58.5	60
	{ Fourth year.....	72.3	69.1
		Boys	Girls
14 day interval.....	{ First year.....	77	61.3
	{ Second year.....	77.1	48
	{ Third year.....	75.6	53.7
	{ Fourth year.....	72.3	69.1

In the tests with both these intervals, the time elapsing from the first to the second test is probably too long.

		Per cent. of correct answers	
		Boys	Girls
7 day interval.....	{ First year.....	81.8	73.9
	{ Second year.....	77.3	69.3
	{ Third year.....	94	79.2
	{ Fourth year.....	86.6	87.2

The 7 day interval shows more satisfactory results than the longer intervals, possibly indicating the importance of a second review within one week from the first review.

The test given after the seven day interval was repeated in the same school for the third time, after an interval of 21 days from the time of the second test, with the following results:

		Per cent. of correct answers	
		Boys	Girls
First year.....		92.4	83.4
Second year.....		84.5	78.4
Third year.....		92	91.8
Fourth year.....		94.6	91.6

This marked improvement seems to point to the conclusion that review after a short interval of about one week followed by review after continually increasing intervals, is the best means of reviving and retaining once familiar facts. Such incidental data, however, is inadequate, for even a tentative judgment on this point.

While no conclusions are drawn from results obtained in this study as to difference of sex, the kinds of questions which are more easily recalled and the type of question which is easily remembered by formal repetition after an interval, some are here indicated. Geographical facts are recalled with about the same readiness as historical in case of the boys, while in case of the girls Geographical facts are more familiar. Dates are difficult for both sexes. Questions involving location in time are more difficult than those requiring visualizing. The preamble of the Constitution is correctly given by few pupils. That is, a fact involving the associations of many words in definite relationships, seems to be less persistently remembered than one expressed by a single word. The little improvement after repetition noted for this question can be accounted for by the fact that the single repetition used in the investigation is inadequate to the revival and the retention of so lengthy and complex a passage.

The results of the 27 boys in School No. 4, who because of the mid-year promotions were in the test two weeks after leaving the grades are worth noting. 26 Boys gave the preamble although two weeks later only 18 boys wrote it. The result for the 33 questions was 73 per cent. for the first test and 89.4 for the second.

It is remarkable how much better the results are for the boys than the girls in the various schools tested. In schools where both sexes attend, the results show a higher percentage of correct answers for the boys. Although the

questions in this test are quite different from those cited by G. Stanley Hall* in the results as worked out by Netschajeff is not greatly in favor of the boys. That test was concerned with memory reproduction of objects, sounds, numbers, visualized words, sound concepts, touch, feeling and abstract ideas after an interval of less than a minute.

The one definite and certain conclusion reached, is the inability of high school pupils, in the absence of occasional review, to retain and to readily recall, even after but a few months interval, the facts most thoroughly memorized in the grammar school course. If the grammar school course contains any facts so important that they should be recalled with maximum certainty in the high school, or after the high school course has been completed, provision must be made for systematic review. While the length of the successive intervals for which such details may remain unreviewed and still be certainly retained is in itself a subject for serious investigation, it is probable that one or two reviews after short intervals at the beginning of the school year may be followed by occasional reviews at continually increasing intervals. If this is true of grammar school work useful at the close of the high school course, it may be equally true of high school work directly useful in college or in after life. May not, for example, the high percentage of failure in freshman mathematics be due to the absence of adequate review of facts, perhaps thoroughly mastered in the earlier high school years that must be certainly remembered in exact relationship, if advanced work in mathematics is to be successfully performed.

*Adolescence. Vol. 2, p. 490.

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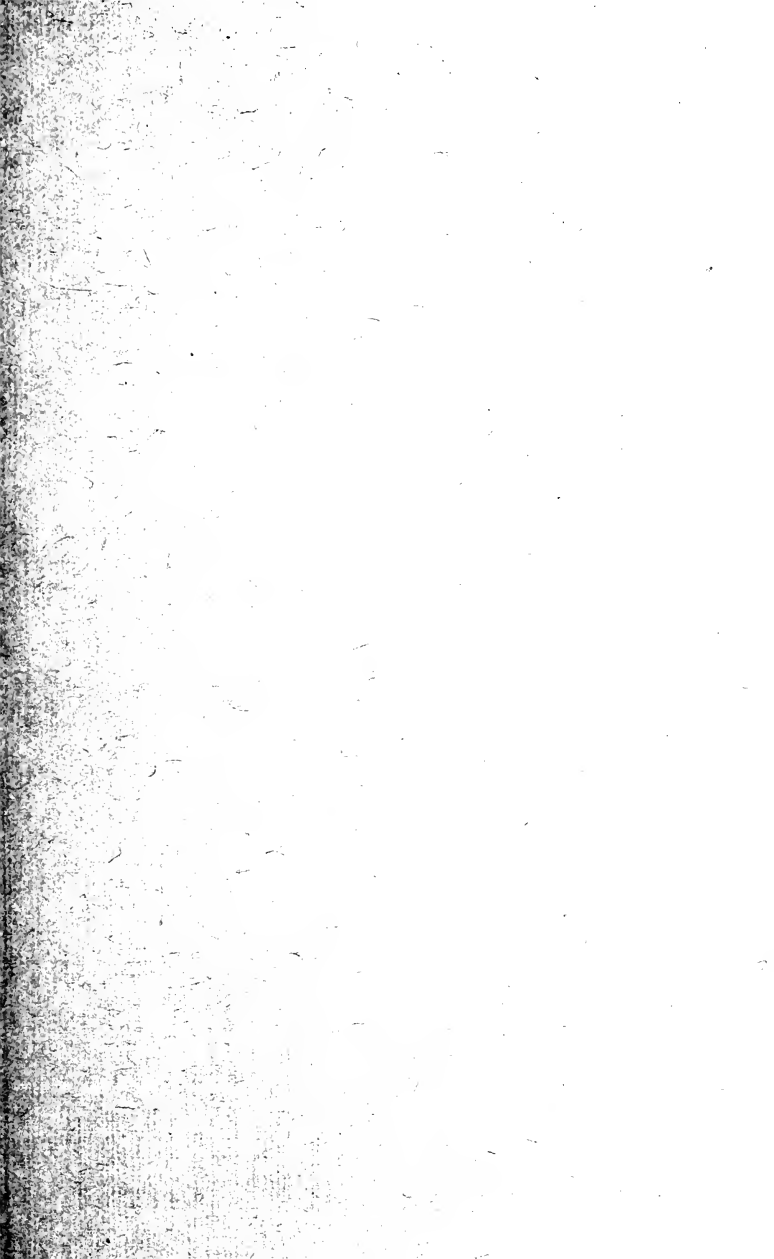
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